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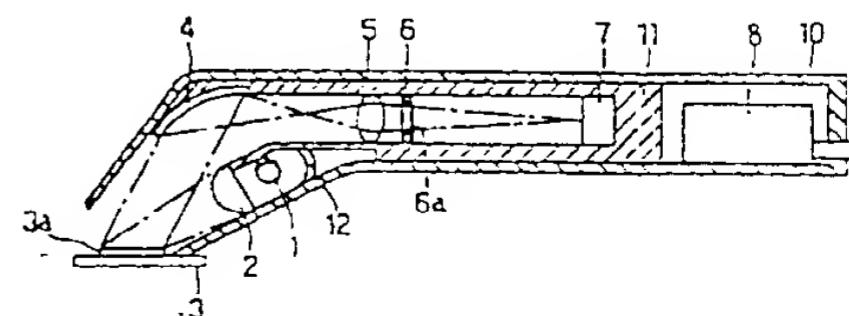
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(54) Bar code scanner.

(57) A bar code scanner for scanning bar codes having a plurality of parallel bar symbols recorded in different light reflective colors on a record medium. The scanner has a light source, an image sensor comprising a plurality of light responsive elements which are aligned and activated one by one, and diaphragm having an aperture which is longitudinally extending in orthogonal relation with the straight line of the aligned elements.

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## BAR CODE SCANNER

BACKGROUND OF THE INVENTION

5        The present invention relates to a bar code scanner for scanning bar codes by an electronically activated image sensor, which is used in such a system that articles of merchandise move together with a record medium (for example, labels or the like) affixed thereto and recorded with the bar codes.

10      In a conventional apparatus for scanning a light reflected from bar codes or contrastive light reflection pattern by an electronically activated image sensor, it is known that an iris diaphragm is provided for projecting enough illuminance on the bar codes so as to clearly image the bar codes on the 15 light responsive elements of the image sensor, and for controlling the focal depth of the bar codes image.

20      While it is generally arranged that the circular aperture of the iris diaphragm is small so as to prevent the defocus of the image or to increase the focal depth, a luminous intensity reflected from bar codes onto the image sensor is reduced by the small aperture and it is required to employ the light source having a large luminous intensity so as to compensate the reduced luminous intensity.

25      When the aperture of the iris diaphragm is large so as to increase the luminous intensity projecting on the image sensor, the focal depth is reduced and consequently the scanning accuracy is reduced.

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SUMMARY OF THE INVENTION

With a view to overcoming the foregoing deficiencies, it is an object of the invention to increase the focal depth without decreasing the 5 luminous intensity of the light reflected from the bar codes onto the image sensor, and thus provide the bar code scanner with greater scanning accuracy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view illustrating the 10 general positions for explanation of the optical system according to the invention;

FIG. 2 is a sectional view illustrating the detailed construction of the invention; and,

FIGS. 3 - 5 are plan views illustrating the 15 first to third embodiments of diaphragm means in FIG. 2.

In the above drawings, the same reference numerals are used to indicate the same or equivalent parts.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the optical system according to the present invention, in which the scanned image of bar codes illuminated by the light source is orthogonally imaged on the straight aligned light responsive elements of the image sensor, an aperture of the dia-phragm member extending in an orthogonal relation with the elements of image sensor.

The present invention will now be described in greater detail with reference to the illustrated embodiments. Referring first to FIGS. 1 and 2, numeral 1 designates a light source such as a bar-shaped lamp which illuminates bar codes 3a printed on a bar code label 3 through a light collector lens 2 of semi-cylindrical shape. The bar codes 3a comprise a plurality of parallel bar symbols recorded in white and in black which are contrastive colors in light reflectivities, and the bar symbols play as a coding with the colors and the widths thereof. Numeral 4 designates a concave reflector mirror for reflecting the reflected light from the bar codes 3a to a specified direction. The light thus reflected by the mirror 4, passing through a convex lens 5 and an aperture 6a of diaphragm member 6, is received by an image sensor 7. As the image sensor 7, a one-directional image sensor is employed for converting the scanned image on a read-in line 7a to an electric signal by means of an electronically scanning operation.

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1 As shown in FIG. 3, the aperture 6a of the  
diaphragm 6 has a shape of rectangle longitudinally  
extending in direction orthogonal to the read-in line  
7a. A one-dot chain line of optical system in FIG. 1  
5 shows a ray in the scanner according to the present  
invention. Numeral 8 designates electronically  
controlled circuits for activating the image sensor 7  
and processing electric signals therefrom so as to  
convert to the desired digital signals corresponding to  
10 the bar codes 3a. Numeral 10 designates an outer  
casing made of synthetic resin which may be handled by  
the operator. Numeral 11 designates an inner casing  
for supporting the concave reflector mirror 4, the lens  
5, the diaphragm member 6, the image sensor 7, the  
15 light source 1, the collector lens 2, and a reflector  
mirror 12 reflecting the light projected by the light  
source 1 onto the bar code label 3.

In the abovementioned construction, the  
apparatus is operated in the following manner. When  
20 the scanning apparatus is provided at the position as  
shown in FIG. 2, the light projected by the bar-shaped  
lamp 1 is converged by the collector lens 2, and  
illuminates the bar code label 3. Since the bar  
symbols of the bar codes 3a are recorded in white and  
25 in black which are contrastive colors in light  
reflectivity, the reflected light has corresponding  
light densities. The reflected light, passing via the  
concave reflector mirror 4, the lens 5 and the aperture  
6a of the diaphragm means 6, is received by the image

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1 sensor 7 on the read-in line 7a thereof. The image  
sensor 7 which is activated by the electronically  
controled circuits 8 converts the scanned image to  
electric signals, and the circuits 8 produce the  
5 desired digitally coded signals corresponding to the  
above electric signals.

Since the longitudinal axis of the aperture  
6a of the diaphragm means 6 is positioned in direction  
orthogonal to the straight image-in line 7a of the  
10 read sensor 7, the focal depth of the axis X as shown  
in FIG. 1 (i.e. the width of each bar symbols of the  
bar codes 3a) becomes wide in response to the decrease  
of width of the aperture 6a. Furthermore, since the  
enough luminous intensity is obtained owing to the  
15 longitudinal length of the aperture 6a in comparison  
with the conventional iris diaphragm, the precise  
scanning is assured and it is not required to employ  
the light source having large luminous intensity.

Still furthermore, since the light reflected by the  
20 axis Y of the bar code label 3 is converged on the  
image sensor 7 by the concave collector mirror 4, it  
is also seen that even the comparatively small  
luminous intensity is satisfactory without decreasing  
the focal depth.

25 The aperture 6a of the diaphragm means may  
be further modified as shown in FIGS. 4 and 5. In  
FIGS. 4 and 5, the diaphragm means 6 has an eliptical  
aperture 6b or a rhombus aperture 6c, the longitudinal

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1 axis of which is extending in parallel with the  
reflected light of the longitudinal axis of the bar  
codes 3a.

5 In place of the lens 5, a concave mirror may  
be provided for imaging on the image sensor 7.

While the diaphragm means 6 is separate from  
the lens 5 in the above description, an opaque tape or  
paint may be applied on the surface of the lens 5 so  
as to form the diaphragm means 6.

10 The present invention is not limited to the  
embodiments described hereinabove but may be modified  
or altered in many ways without departing from the  
spirit of the invention.

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What is claimed is:

1. In a system for scanning bar codes having a plurality of parallel bar symbols recorded in different light reflective colors, a bar code scanner comprising:
  - / a casing;
  - a light source supported within said casing and illuminating said bar symbols;
  - an image sensor supported within said casing and being electronically activated one by one to convert reflected light applied from said parallel bar symbols into responsive electric signals, the longitudinal axis of said bar symbols being reflected orthogonally onto the straight read-in line of said image sensor; and
  - diaphragm member supported within said casing at a portion between said bar symbols and said image sensor and having an aperture, the longitudinal axis of said aperture extending in orthogonal relation with said straight read-in line of said image sensor.
2. A bar code scanner according to Claim 1, wherein said aperture has a rectangular shape.
3. A bar code scanner according to Claim 1, wherein said aperture has an elliptical shape.

4. A bar code scanner according to Claim 1,

wherein said aperture has a rhombus shape.

5. A bar code scanner according to Claim 1

further comprising a lens supported within said casing at a position between said bar symbols and said image sensor and focusing the light reflected from said bar symbols onto said image sensor.

6. A bar code scanner according to Claim 5,

wherein said diaphragm member is formed directly on the surface of said lens.

7. A bar code scanner according to anyone of

Claims 1 or 5 further comprising a lens supported within said casing at a position between said light source and said bar symbols and converging the light projected by said light source onto said bar symbols.

8. In a system for scanning bar codes having a

plurality of parallel bar symbols recorded in contrastive light reflection colors, a bar code scanner comprising:

a casing;

a light source supported within said casing and illuminating said bar symbols;

an image sensor supported within said casing and being electronically activated one by one to convert reflected light applied from said parallel bar

symbols into responsive electric signals, the longitudinal axis of said bar symbols being reflected orthogonally onto the straight read-in line of said image sensor;

diaphragm member supported within said casing at a portion between said bar symbols and said image sensor and having an aperture, the longitudinal axis of said aperture extending in orthogonal relation with said straight read-in line of said image sensor;

a lens supported within said casing at a position between said bar symbols and said image sensor and focusing the light reflected from said bar symbols onto said image sensor;

a lens supported within said casing at a position between said light source and said bar symbols and converging the light projected by said light source onto said bar symbols;

a first reflector mirror supported within said casing and reflecting the light reflected from said bar symbols onto said image sensor; and,

a second reflector mirror supported within said casing and reflecting the light projected by said light source onto said bar symbols.

FIG.1.

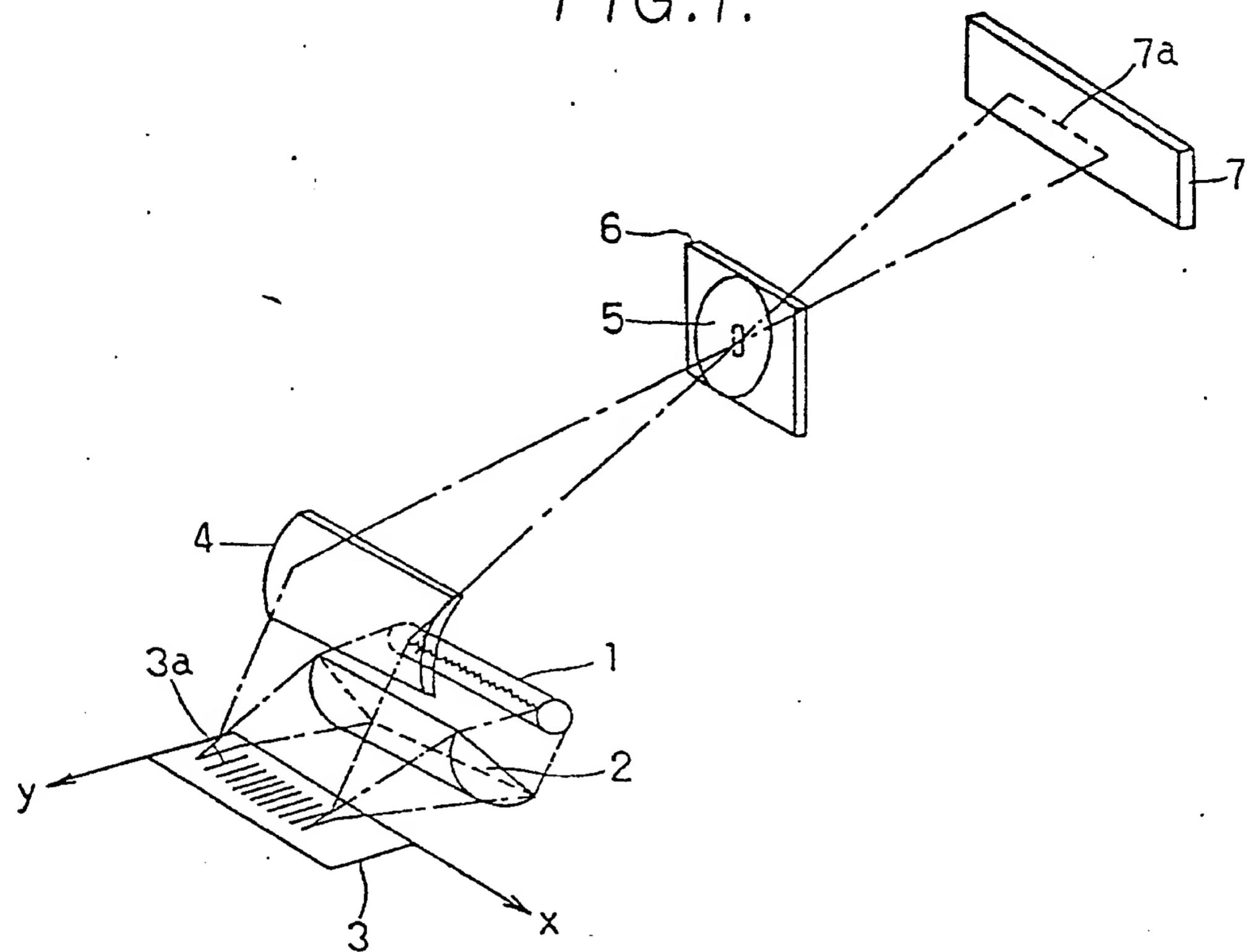


FIG.2.

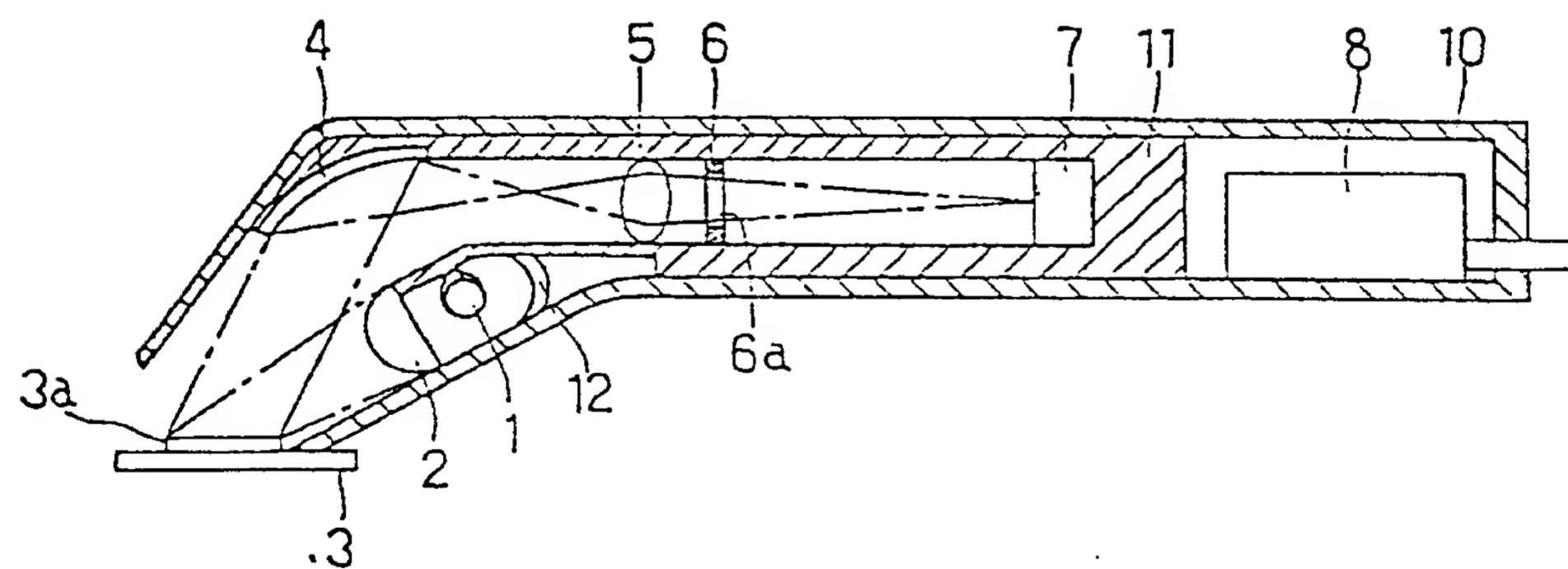


FIG.3.

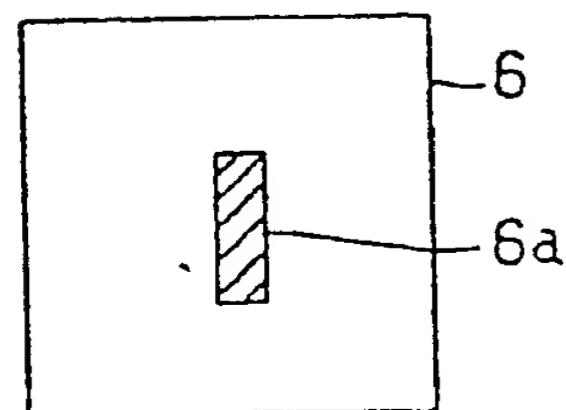


FIG.4.

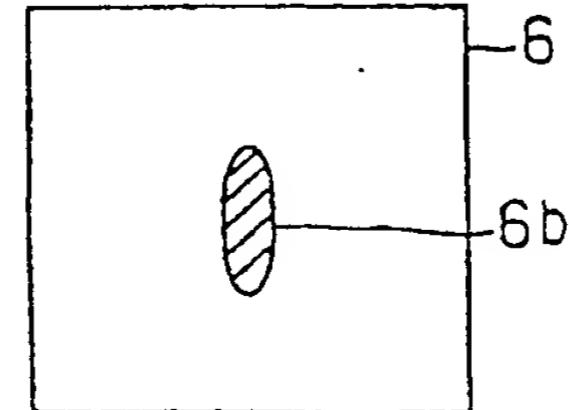
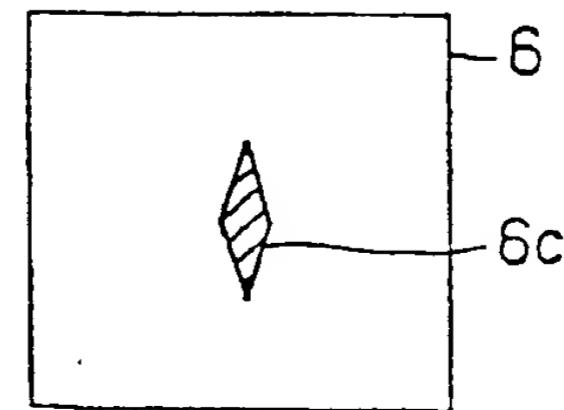


FIG.5.





DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> )
Y	FR-A-2 212 967 (BERTIN) *Figures 1-9; from page 2, line 26 to page 5, line 8*	1-7	G 06 K 7/10
Y	---	1-7	
Y	US-A-3 553 468 (DENCH) *Figures 1-3; from column 1, line 61 to column 2, line 61*		
Y	---	4	
Y	US-A-3 684 866 (JONES) *The whole document*		
Y	---	3	
Y	US-A-3 351 765 (MALONE et al.) *Figures 1-4; from column 3, line 22 to column 5, line 11*		
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TECHNICAL FIELDS SEARCHED (Int. Cl. <sup>3</sup> )			
G 06 K 7/10			

The present search report has been drawn up for all claims

Place of search  
THE HAGUE

Date of completion of the search  
29-06-1982

Examiner  
FORLEN G.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone  
Y : particularly relevant if combined with another document of the same category  
A : technological background  
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P : intermediate document

T : theory or principle underlying the invention

E : earlier patent document, but published on, or after the filing date

D : document cited in the application

L : document cited for other reasons

& : member of the same patent family, corresponding document